Relative Potential Consequences of Alternative Operational Scenarios for Centrarchid Populations in Brownlee Reservoir (Smallmouth Bass and Crappie spp.) (E.3.1-5 Chapter 4)

John W. Anderson
AFS Certified Fisheries Scientist
Cold Stream Consulting, P.O. Box 575 Baker City, OR 97814
Contracted by the
Oregon and Idaho Bureau of Land Management
November 9, 2002

I. Introduction

The purpose of this study is to determine the affects of hydropower operations on smallmouth bass and white and black crappies. This report evaluated three mechanisms that potentially may impact centrachid populations in Brownlee Reservoir: (1) downstream export, (2) nesting success, and (3) over-winter survival. This report builds on information collected and presented in E.3.3-5, chapter, 1 and 2 that evaluated nesting success and juvenile densities in Brownlee Reservoir.

II. Conclusions

*1. "**Smallmouth Bass***

•Of the three mechanisms evaluated, only water-level fluctuations as they relate to nesting success (and thus reproductive success) were substantially affected by operational scenario and H-Y [hydrologic-year] *type.*

•The pattern of increasing nest success from low to high H-Y type was somewhat more pronounced for RRFP [Run-of-River Full Pool] *than for the proposed operation.*

•Effects of operational scenario and H-Y type on downstream export and over-winter survival do not appear to be of concern.

•Differences in operational scenario and H-Y type are likely to affect annual population growth rate more by affecting reproduction than by affecting survival.

White Crappie

•Of the three mechanisms evaluated, primarily downstream export, and secondarily water-level fluctuations as they relate to nesting success, were affected by operational scenario or H-Y type.

•Negative effects of downstream export increased from low to high H-Y type for both operational scenarios.

•The pattern of increasing nest success from low to high H-Y type was somewhat more pronounced for RRFP than for the proposed operations scenario.

•Effects of operational scenario and H-Y type on over-winter survival were assumed to have little effect on the population.

•Differences in operational scenario and H-Y type are likely to affect annual population growth rate by simultaneously affecting both reproduction and survival." (Pages 15, Paragraph 5 and Page 16, Paragraphs 1-8)

"Comparison of Species at the Population Level and Generalization to Other Centrarchids and Brownlee-type Reservoirs

•White crappie and smallmouth bass both experienced the same annual sequence of operational scenarios and H-Y types in Brownlee Reservoir during the 1990s. White crappie abundance was appreciably more variable than smallmouth bass abundance. While variable, abundance of both populations was stable through the 1990's (i.e., no increasing or decreasing trend). However, the negative correlation coefficient between the two time series of relative abundance values suggests that the two populations were affected differently by the set of abiotic and biotic factors to which they were exposed. These factors, in addition to operational scenario and H-Y type, include water quality and fishing mortality. The species differences in abundance patterns likely reflect species differences in life history characteristics (in particular, development time from egg to dispersal from the nest and habitat utilization following dispersal), which in turn determined the set of abiotic and biotic factors to which each species was exposed. By considering these two differences in life history characteristics, our results indicate that operational scenario and H-Y type can affect reproductive success of both species, whereas white crappie are much more susceptible than smallmouth bass to reduced survival after dispersal because of involuntary downstream export. However, data on actual downstream export (magnitude & timing by age class) are neither available nor readily collectible." (Page 16, Paragraph 9)

• "The assessment approach and pattern of results from this study can be extrapolated to other centrarchid populations in Brownlee Reservoir and similar reservoirs, based on consideration of life history and reservoir characteristics." (Page 16, Paragraph 10)

Response: The BLM agrees with these findings. However, the BLM does not believe this study is complete or adequate to fully answer the questions posed by the Aquatic Resource Work Group. The study make assumptions about transport and entrainment that were not documented by the research.

III. Study Adequacy

The BLM believes the study is inadequate due to the number of unsubstantiated assumptions placed in the model.

The report models data and arrives at conclusions that are based on a number of assumptions that may not be correct. It was assumed that crappie could be used as a

surrogate for smallmouth bass behavior in part of the study. There was a failure to sample for entrained crappie spp. and smallmouth bass. It is known that these species are entrained, but the magnitude of the entrainment should be determined to verify the Applicant's assumption. Fish species entrained into the Hells Canyon Reach below Hells Canyon Dam are potential competitors and predators on native salmonids.

The study recognizes white crappie and black crappie as different species. At times, the results are lumped as crappie spp. and at other times they are referred to separately. The inconsistency in reporting on the two species creates confusion in the report. The authors should deal with these discrepancies.

IV. BLM Conclusions and Recommendations

Conclusions

Through modeling the available data, researchers theorize that the main factors influencing smallmouth bass and crappie populations are: (1) Reservoir water-level fluctuations that directly affect nesting success. (2) The current operations (CO) flow scenario is more likely to negatively affect crappie and smallmouth bass nesting than the run-of-river full pool (RRFP) scenario. (3) Crappie nesting success is less affected by reservoir fluctuations than that of smallmouth bass. (4) The negative affect on young-of-the-year crappie populations increased as the magnitude of the flow year increased (the juveniles move into open water and are swept downstream by strong currents). (5) The RRFP flow scenario would most likely provide the best production of smallmouth and crappie.

The report reiterates the point made previously that when the reservoir is drafted below the level where smallmouth bass and crappie spawn, there are negative affects on the population.

The majority of the report relies on population modeling. Two operational scenarios, Current Operations and FPRR were addressed. The model used three hydrologic flow year types (low, medium, and high) to evaluate three mechanisms' (juvenile export, nesting success, and over-winter survival) affects on the population. The model produced six combinations of flow scenarios that provide a range of conditions that crappie and smallmouth bass populations are most likely to experience.

The model should be viewed as a hypothetical assessment. There are several areas of the model that do not have information to support some of the assumptions. The report states: (1*) "Downstream export of white crappie has not been studied and, in fact, would be difficult to quantify, especially for age-0 fish." (2) "To estimate the ratio for over-winter survival (f_{winter}) for smallmouth bass, we used an existing bioenergetics method. In the absence of similar studies for crappie, we assumed that crappie would follow patterns similar to those determined for smallmouth bass."* The report notes that*: "We are more confident in our assessment of the effects of operational scenario and... hydrologic year... (H-Y) type on nesting success than on downstream export because of IPC's multi-year study on nesting success (Richter and Chandler 2001a,b)."*

The model provides what appears to be a reasonable hypothesis of the affects of the two flow scenarios based on current level of knowledge. The lack of information on entrainment of crappie larvae that are known to move into the open water reservoir and be affected by flow should have been addressed by the Applicant. The statement that the downstream export of white crappie would be difficult to quantify seems out of line with the willingness of the Applicant to model the affect on the centrachid population in question. The ability to sample fish being entrained over the dam or through the turbines is not insurmountable. The same tow nets they described in chapter 2 could have been used immediately below the dams to determine the relative abundance of smallmouth bass and crappie in the zero age class. Any larvae captured would have come from above the dam because fish of that size cannot swim upstream into the flows coming from the dams.

The conclusions about over-winter survival may be reasonable, but they are based on the following unsubstantiated assumption on page 13, paragraph 1 of the report: "*....However, given that (1) Shuter et al. (1980) applied their model to smallmouth bass only, (2) comparable bioenergetics input data are not available for white crappie, and (3) predicted minimum lengths for age-0 smallmouth bass were well above the minimum threshold lengths for reduced survival, we assumed that over-winter survival of age-0 is not a population issue for white crappie.*"*....* This does not appear to be logical. There is no explanation of why the reader should reach the conclusion that the two species would behave in the same way.

Recommendations

1. Entrainment studies should be conducted to determine the affect of flow scenarios on downstream export of crappie and smallmouth bass past and through the HCC dams. The study would include species, age, and relative abundance of fish being entrained at different flows and seasons. The entrainment issue was raised numerous times by the Aquatic Work Group, and IPC has refused to address it.

2. Winter survival studies should be conducted for crappie to validate the model assumptions that smallmouth bass are an applicable surrogate.